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Editorial: IWPT-5 Special issue

Tomography Measurement & Modeling of Multiphase Flows (TM^3)

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Multiphase flows are commonly encountered in many engineering systems and industrial processes. Measurement of flow parameters involving multiphase flow has gained considerable attention not only for process monitoring but also involves safety issues. To describe the hydrodynamic properties of multiphase flow, parameters with respect to each phase have to be determined. Moreover, across the flow cross-section, the phase distribution and velocity profile varies spatially and temporally. Thus, the dynamic interaction between the phases makes the flow complex and poses great difficulty in measurement point of view. Advancement in instrument technology led to considerable progress in flow visualization. In this perspective several measurement techniques are developed for monitoring of multiphase flows. However, none of these methods could satisfy completely the challenges that are faced in real industrial applications.

To fully understand the multiphase flow phenomenon and develop methods for measuring flow parameters a comprehensive research is necessary. The 5th International Workshop on Industrial Process Tomography (IWPT-5) held in Jeju, South Korea, September 16–18, 2014, was an excellent platform for specialists to present and discuss their most recent advancements in the development of multiphase flow visualization. The 5th International Workshop on Process Tomography is a continuation of the successful events which were held in Beijing and Hangzhou – China (2005), Macau – China (2006), Tokyo – Japan (2009), Chengdu – China (2011). This special issue is solely dedicated to the measurement techniques and modeling of multiphase flows. This special issue contains 17 papers selected from those presented at the IWPT-5. The papers have been thoroughly reviewed and modified to take account of the referee's comments. The list of papers here covers a broad range of scientific approaches to multiphase flow imaging for different application areas.

Various measurement strategies for multiphase flow measurement are expressed in this issue. Frank et al. proposes velocity measurement methods for two-phase flow using ultrafast x-ray tomography. Recent developments in sensor hardware for multiphase flow are presented by Wang et al. A research prototype is reported for multiphase flow measurement that consists of electrical impedance tomography sensor with electromagnetic flow meter (EMF) and a flow mixture density meter (FDM). A calibration method for online conductivity of EIT sensor is described by Jia et al. The online conductivity calibration helps in reducing the drift error thereby improving the monitoring of long-term dynamic process. A conductance-capacitance

sensor for water holdup measurement is proposed by Dong et al. for oil-water two phase flows. Multiphase flow visualization methods are discussed in the two articles. A refined reconstruction method of liquid-gas interface using wire mesh sensor is addressed by Eckhard et al. In Zhang et al three phase flow imaging with dual modality ECT-MIT is reported. Another dual modality method using ERT-EMF is proposed by Faraj et al for measurement of vertical oil-in-water two-phase flow. Visualization of gas phase distribution in industrial centrifugal pumps with gamma-ray computed tomography (GCT) is implemented by Bieberle et al. Novel image reconstruction methods for process tomography applications is discussed. Song et al implemented a hybrid regularization method that combines Tikhonov and total variation methods for electrical resistance tomography (ERT). A fast inversion method using Eigen value and Eigen vector is proposed to reduce the computational time of inverse solution in Kim et al. Zhao et al proposed a dimensionality reduction method using orthogonal projection. An inverse algorithm package is reported by Wei et al and his co-workers. Analytical method based on hybrid meshless method is developed for solving ERT forward problem in and its accuracy is compared with boundary discretization methods. New emerging technologies related to tomography applications are addressed by Khambampati et al. Deguchi et al. presents a method of Computer Tomography (CT) tuneable laser absorption spectroscopy for concentration and temperature measurement in combustible engines. In another application, measurement of high temperature fields in combustible engines is reported (Kamimoto et al). An application for water lubricated for oil transportation using EIT is presented by Choi et al. The last application in this issue is related to blood clot detection with EIT for application related to extracorporeal devices (Sapkota et al).

As guest editors, we hope that this special issue helps further developments in measurement and visualization of multiphase flow in various industrial applications. We wish to express our thanks to the authors, the referees, the JFMI publication team and the Organizing Committee of IWPT5 2014 for their role in bringing these valuable scientific findings to the special issue of JFMI.